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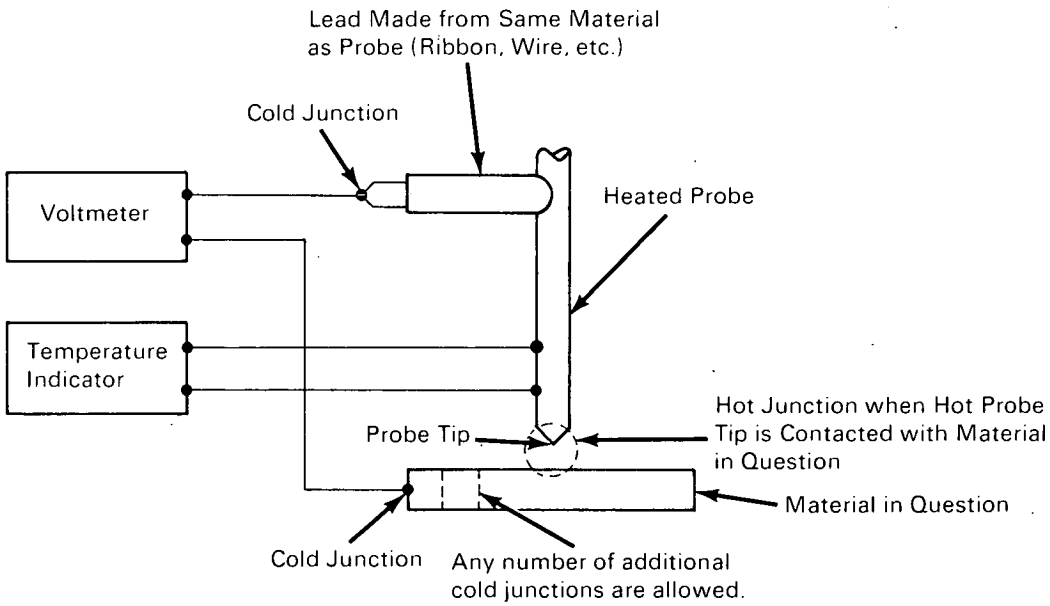
NASA TECH BRIEF

Identification of Thermocouple Material



The problem:

Identify "unknown" materials used in the fabrication of thermocouple junctions.

The solution:

Fabrication of probes from a representative selection of materials used to make thermocouples. By use of the Seebeck Effect (the generation of a thermoelectric electromotive between hot and cold junctions) the material in question can be verified whether it is the same as the probe or not.

How it's done:

The probe with a lead made of the same known material is heated by any convenient means. The hot probe is then made to contact the material to be identified forming a hot junction at the probe tip. If the material being identified is the same identical material as the hot probe, no thermoelectric voltage is generated; therefore, a zero or very small voltage will be measured at the voltmeter regardless of the temperature of the hot junction formed. If the material being identified (the object) is not identical to the probe material, a thermoelectric voltage will be generated. The voltage measured by the voltmeter will be a function of the tip/object junction temperature difference from the cold junctions and the thermoelectric power coefficients of the thermocouple circuit formed. The magnitude and sign of the thermoelectric voltage can be used to identify the object as different than the probe giving go no-go determinations and/or when the probe tip to cold junction temperature difference is

(continued overleaf)

controlled, the object can be identified from previously established probe/object output voltages.

Contact-pressure control, probe-temperature control and cold-junction temperature equality control improves resolution and object identifiability. Minor thermoelectric voltages due to minor temperature differences in the thermocouple circuit and minor differences in probe and lead materials can be bucked out using conventional means. The total thermocouple circuit can have any number of dissimilar junctions in the cold part of the circuit as long as all of these junctions are at a similar temperature and only the tip/object junction temperature is different. This includes dissimilar junctions between the object-material test point and the electrical connection point in a complex structure. The invention will also work if the probe is cooled to a temperature lower than the other circuit junctions giving opposite polarity voltages but otherwise working as described. The sensitivity of the invention towards sensing object/probe differences is increased with increased temperature difference between the probe/object function and the other junctions. Any number of cold junctions can exist within the object and within the rest of the thermocouple circuit as long as all junctions remain at the same temperature.

Note:

No further documentation is available. Inquiries may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B69-10356

Patent status:

No patent action is contemplated by NASA.

Source: John J. Vrolyk and Roger F. Nelson of
North American Rockwell Corporation
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